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EFFECT OF DIFFERENT NUTRIENT MEDIA ON THE GROWTH OF SOME ARACEAE FAMILY PLANTS DURING *IN VITRO* ROOTING AND ADAPTATION STAGES

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ABSTRACT

This work aims to study the effect of *in vitro* (tissue culture media) and *ex vitro* (planting media) conditions on growth of some Araceae plants (*Syngonium podophyllum, Spathiphyllum wallisii and Philodendron scandens) The obtained* results indicated that MS basal medium at full salt strength supplemented with 30 g/l sucrose produced the highest shoot length, fresh weight and number of roots for *Syngonium podophyllum*. While MS at quarter salt strength supplemented with 10g/l sucrose was suitable to *Spathiphyllum wallisii,* which gave the highest shoot length and number of leaves. The best medium for root formation was MS basal medium supplemented with 10 g/l sucrose. For *Philodendron scandens* plants, the results pointed out that shoots cultured in MS at quarter salt strength with 30g/l sucrose gave the highest values of fresh weight, root length and number of roots.

For the effect of planting media, the data indicated that MS at full salt strength with 30g/l sucrose during rooting stage and planting medium containing peat: sand at 3:1 (v/v) gave the highest survival percentage for *Syngonium podophyllum* plants.

The best growth and development of *Spathiphyllum wallisii and Philodendron scandens* plants during acclimatization stage were recorded for plantlets produced from MS at quarter salt strength with 10g/l or 20g/l sucrose during rooting stage and acclimatized in the previous planting medium (peat : sand 3:1 v/v), respectively.

INTRODUCTION

Sugar is a very important component in any nutrient medium and it's addition is essential for *in vitro* growth and development, because photosynthesis is insufficient, due to the growth taking place in conditions unsuitable for photosynthesis or without photosynthesis (in darkness). Green tissues are not sufficiently autotrophic *in vitro*. The CO_2 concentration in the test tube can also be limiting for photosynthesis and in practice it is very difficult and expensive to feed CO_2. In reality, as a result of poor gaseous exchange, the CO_2 concentration in the tubes or containers may become too high and therefore toxic. A concentration of 1-5% sucrose is usually used *in vitro,* since this sugar is also synthesized and transported naturally by the plant (Weston and Street, 1968). Sucrose in the root developing medium is one of the major factors for both obtaining a high rooting percentage and promoting root elongation. The role of sucrose in rooting is more closely linked to the energy supplies than to its osmotic properties, as observed by Hyndman *et al.* (1982) on rose shoots. Vinterhalter *et al.* (1990) mentioned

that root elongation of *Dracaena fragrans* was not considerably influenced by the concentration of sucrose in the medium, since it occurred even on sucrose-free medium, reaching nearly 75% of the final root length registered at the optimal sucrose concentration (2.0%). Also, from the 21st day onward, lines representing certain treatments were roughly parallel, indicating that sucrose influenced only root initiation. Chenevared *et al.* (1995) showed that the highest rooting percentage for *hybrid walnur* was obtained on medium containing 40 g.l^{-1} sucrose. Sucrose is also required in the root- development medium for the promotion of root number. El-Kazzaz *et al.* (1997) showed that, addition of 3% sucrose to culture medium led to higher percentages of root formation of mulberry shoots.

Wainwright and Scrace (1989) reported that, establishment of *Ficus* plants was lowest when preconditioned on medium containing no sucrose as was the case with *Potentilla*, yet 62.5% of the plants were successfully established. Capellades *et al.* (1991) observed that the unrooted rose shoots grown on a high sucrose concentration accumulated starch in the chloroplast and showed the highest survival rate during acclimatization.Van Huylenbroeck and Debergh (1996) studied the effects of an important nutrient reserve (by increasing the sugar concentration) *in vitro* on subsequent acclimatization process at transplanting dry weight was significantly higher for *Spathiphyllum* cv. Petite plantlets micropropagated on 6% sucrose - containing medium compared to control plants grown on 3% sucrose. Both treatments resulted in 100% survival.

After sugars, minerals are the next most important group of nutrient materials for *in vitro* growth. There is a large choice of combinations of macro-and micro-salt mixtures. The mixture of macro-and micro-salts chosen is strongly dependant on the experimental plant. Murashige and Skoog (1962) medium is very popular, because most plants react to it favourably. However, it should be appreciated that this nutrient solution is not necessarily always optimal for growth and development, since the salt content is so high. For example *Gerbera* is salt sensitive *in vitro* (Pierik 1987).

Gleba and Gordzievskaya (1987) on *Platycerium bifurcatum,* plantlets were rooted successfully in MS medium without growth regulators and in MS medium diluted 10 fold. Desilets *et al.* (1993) reported that *Pelargonium x hortorum* plantlets rooted easily on a half strength MS medium without growth regulators. Acclimatization of *Pelargonium x hortorum* plantlets was characterized by high survival rates (94%). Abd El-Kareim (1997) found that MS medium at half strength without IBA was more effective in increasing the root length (2.06 cm) than MS at full strength without IBA (1.69 cm) of *Yucca elephantipes*. Awad *et al.* (1991) on carnation, found that the best mixture of soil was peat and sand (2:1 v/v). The percentage of survival after 4 weeks was 70% and 80% to plantlets derived from agar and liquid media, respectively. Abd El-Kareim (1997) stated that growing the plantlets of *Yucca elephantipes* in peatmoss alone or a mixture of peatmoss + sand at 2:1 showed a high benefit on quality of roots formed on the plantlets (number and length), whereas, the other growing mixtures were more favorable for shoots and leaves formation.

The present work aims to study factors affecting rooting and adaptation stages. This study included the: effect of MS salt strength and sucrose concentrations on growth and development of some Araceae plants growing *in vitro* (rooting stage) and effect of planting media on survival percentage of these plants grown *ex vitro* (adaptation stage).

MATERIALS AND METHODS

This investigation was carried out at Laboratory of Plant Tissue Culture Agricultural Development Systems Project (ADSP), Ministry of Agriculture, Egypt, throughout the two successive years 1996 and 1997. Shoot tips of *Syngonium podophyllum; Spathiphyllum wallisii* and *Philodendron scandens* plants were obtained from one-year old plants growing in the greenhouse in the nursery of ADSP at Fac. of Agic, Cairo University.

The explants were cut into pieces (2cm length) containing shoot tips and soaked in chlorox. solution at 60% (3% NaOCl) concentration with one drop of Tween 20 (Polyoxyethlene sorbitan monolaurate) used as a wetting agent per 100 ml of sterilizing solution for 20 minutes. After sterilization of the explants, most of the leaves surrounding the shoot tip were removed, then the explants were transferred to sterilized distilled water (3 times), the explant to about 1cm length. Each explant was placed vertically in a culture tube (150 x 25mm) containing 20 ml. of Murashige and Skoog (1962) basal medium supplemented with 2mg/L BA + 30 g/L sucrose. The media were autoclaved at 121 C^0 and 1.2 kg / cm^2 for 20 min. All culture tubes were incubated for a month in growth room at 26$\pm$2 C^0 under 16 hr illumination of 2000 Lux (white fluorescent lamps). The explants were produced from the previous starting stage transferred to the same medium for clonal propagation. MS basal medium was used in this study containing 30 g/L sucrose, 100 mg/L inositol, 0.5 mg/L pyrodoxin, 0.5 mg/L nicotinic, 0.1 mg/L thiamine, 2 mg/L glycine and 2 mg/L BA (Jambor – Benczur and Marta – Riffer 1990). The media were solidified with agar, (7 gm/L) and pH was adjusted to 5.7 and media were distributed 60 ml in each 350 mm. culture jar. The media were incubated at 26 $\pm$ 2^0C under 16 hrs illumination of 2000 lux from cool white fluorescent lamps. Shoots were transferred to the rooting media for the following study.

I- Effect of MS salt strength and sucrose concentration on rooting *(in vitro).*

This experiment was carried out to study effect of MS salt at different strengths (full, half and quarter) combined with different concentrations of sucrose (10, 20 and 30) on growth and development of *Syngonium Podophyllum, Spathpihyllum wallisii* and *Philodendron scandens* cultured *in vitro* (rooting stage). Three shoots at length of 1.5 cm produced from the multiplication stage (MS + 2mg/L BA+30g/L sucrose) were cultured in each jar (350 ml) which contained 60 ml of the previous media (Table 1).Each treatment included 8 jars, each jars contained 3 explants and incubated in growth room at 26 $\pm$ 2 C^0 under 16 hrs illumination of 2000 lux (white

florescent lamps). The following data were recorded after six weeks. (per cluster for *Syngonim* and *Spathiphyllum* and per plant for *Philodendron*).

1- shoot length (cm). 2- Number of leaves.
3- Leaves area (cm^2). 4- Fresh weight (gm).
5- Number of roots. 6- Root length (cm).

II- Effect of planting media and tissue culture media in the greenhouses (adaptation stage)

The plantlets produced from the previous treatments in rooting stage, were transfered *ex vitro* in the following planting media :

1- Peatmoss 100%. 2- Peatmoss + sand (1 : 1 v/v).
3- Peatmoss + sand (2 : 1 v/v). 4- Peatmoss + sand (3 : 1 v/v).

The plantlets were individually transplanted in the 6 cm plastic pots containing one of the previous mixtures of peatmoss and sand, therefore 4 treatments were done. Before planting, all plantlets were washed thoroughly with tap water to remove remains of the agar from the roots system. Each treatment was replicated 8 times. The plantlets were kept in the greenhouse under light intensity of 2000 lux and high relative humidity (90%) using white polyethylene bags for a month and then the plantlets were kept without polyethylene bags and pots were fertilized with 0.25 Hoagland salt strength solution. The survival percentage was recorded. (per cluster for *Syngonium and Spathiphyllum* and per plant for *Philodendron*) after three months

Statistical design

The randomized factorial design was used and data were subjected to analysis of variance. Separation of means among treatments was determined using L.S.D test at 5% (Steel and Torrie ,1980)

RESULTS AND DISCUSSION

I- Effect of MS salt strength and sucrose concentrations on growth and development of some Araceae plants grown *in vitro* (rooting stage).

1- *Syngonium podophyllum*

The data indicated that, the best medium to increase shoot length was that contained half strength of MS and 30g/L sucrose. (5.68 cm) in table (1). While the highest number of leaves was obtained on the medium contained quarter MS + 10g/L sucrose (13.88) and MS full + 20g/L sucrose (13.25). These results are in line with Chenevared *et al.* (1995) who mentioned that the number of mature leaves per rooted shoots decreased in walnut plantlets with high sucrose concentration.

The biggest leaf area ($2cm^2$/leaf) was produced when the medium was containing quarter MS +20 g/l sucrose. The optimum nutrient medium for increasing fresh weight for *Syngonium podophyllum* was that contained MS half basal medium at full strength supplemented with 30g/L sucrose (1.54gm). Number of roots increased gradually by increasing sucrose concentrations.

It was 4.14, 7.83 and 8.36 when nutrient medium was supplemented with10, 20 and 30 g/L sucrose, with significant difference between 10 g/L and 20 or 30 sucrose added to MS nutrient medium. Results under discussion are in line with Chenevared *et al.* (1995) who reported that high sucrose concentrations in the root development medium significantly increased the length of root system of hybrid walnut microcuttings. MS basal medium at different strengths did not significantly affect the number of roots. The interaction between sucrose concentrations and MS salt strength was significant for root number of *Syngonium podophyllum* plantlets. The best medium was MS (regardless the strength) basal medium supplemented with 20g/L sucrose which led to the best result for root formation where root length was 5.47 cm compared to 3.04 cm and 4.44cm for 10 and 30g/L sucrose added to nutrient medium with significant difference among the treatments. Regarding the effect of MS salt strength on root length, data presented in Table (1) show that $^1/_4$ MS gave the best results of root length (4.80 cm) compared to half (3.88 cm) and full strength (4.28 cm). The interaction between sucrose concentrations and MS salt strength was significant. The best nutrient medium giving the tallest roots was that which contained quarter MS + 20 g/L sucrose (6.30 cm).In general, the obtained results indicated that MS basal medium supplemented with 30 g/l sucrose increased fresh weight and number of roots and it may be the best medium in rooting stage for *Syngonium podophyllum* plantlets. The obtained results are in line with the general trend of previous reports (Takayama and Misawa, 1982; Pua and Chong, 1985; Mackay and Kitto, 1988; Ibrahim and Arafa, 1994).

2- *Spathlphyllum wallisii*

The obtained data (Table 2) indicated that MS basal medium at different strengths supplemented with 10g/L sucrose significantly increased the shoot length (3.16 cm) compared to 20 and 30 g/L sucrose (2.75 and 2.29 cm, respectively).

The interaction between MS salt strength and sucrose concentration revealed that MS at quarter salt strength with 10 and 20g/L sucrose gave the highest number of leaves with significant difference in between (13.46 and 14.75, respectively) compared to half salt strength with 10g/L sucrose and quarter salt strength with 30g/L sucrose (10.68 and 10.96, respectively). which resulted in the lowest number of leaves.

The recorded data showed that there was not significant effect of sucrose concentrations and MS salt strength on leaves area and fresh weight .The present data (Table 2) also indicated that using 10 g/L sucrose significantly increased the number of roots (5.24) compared with 20 and 30 g/L sucrose (3.88 and 3.66, respectively). The interaction between MS salt strength and sucrose concentrations showed that MS at the full salt strength with 10g /L sucrose led to the highest number of roots (6.16) compared with half salt strength with 20 g/l sucrose and half salt strength with 30 g/l sucrose (2.44 and 2.64, respectively). Using MS at quarter salt strength significantly increased the root length (1.77 cm) compared with MS at half and full salt strength (1.09 and 1.36 cm, respectively). Using 10 and 20 g/L sucrose significantly increased the root length (1.54 and 1.45cm, respectively) compared with 30g/L sucrose (1.24 cm). On the other hand, there was no significant difference in root length between 10 and 20g/L sucrose.

The interaction between MS salt strengths and sucrose concentrations indicated that MS at quarter salt strength with 10g/L sucrose gave the highest root length (2.16 cm) compared with half salt strength with 20 and 30 g/l sucrose (0.98 and 1.14 cm, respectively).

These results are in agreement with the findings of (Takayama and Misawa, 1981; Thentz and Moncousin, 1984; Pasqual *et al.*, 1994 and Chenevared *et al.*, 1995) on *Begonia hiemalis, Platycerium bifurcatum, Nephrolepis exaltata* and *Juglans nigra* × *Juglans regia,* respectively.

3- *Philodendron scandens*

Data in (Table 3) indicated that the interaction effect between MS salt strengths and sucrose concentrations showed no significant difference in shoot length, number of leaves and leaves area. Data on the interaction effect between MS salt strengths and sucrose concentrations showed significant difference at 5% level in fresh weight, MS at quarter salt strength with 30g/L sucrose resulted in the highest fresh weight (0.49 gm) compared with MS full salt strength with 10g/L or 30gll sucrose which gave the lowest fresh weight (0.20 gm).

Using MS at quarter salt strength significantly increased the root length (5.71 cm) compared with MS at full salt strength and there were significant differences in root length between MS at full and half salt strength. The data also indicated that using 30g/L sucrose significantly increased the root length (5.70 cm) compared with 10 and 20 g/L sucrose (3.59 and 4.29 cm), and there were significant differences in root length among 10 and 20 g/L sucrose. The interaction effect between MS salt strength and sucrose concentration indicated that the MS at quarter salt strength with 30g/L sucrose gave the highest root length (7.80 cm) compared with MS at full salt strength with 10g/L sucrose (3.11 cm). MS at quarter and half salt strength with 30g/L sucrose led to the highest number of roots (5.41, 6.00). Similar results were obtained by Tsay *et al*., 1989; Camloh and Gogala, 1991; Hasegawa *et al.*, 1995 and Abd-El Kareim, 1997) on *Pinellia ternate, Platy cerium bifurcatum , Eucharis grindelia, Yucca elephantine,* respectively.

II-Effect of Planting media (Peat moss and Sand) and tissue culture media (MS salt strength and sucrose concentration) on the survival percentage (adaptation stage) *ex vitro*

Data presented in (table 4 and fig 1) show the effect of soil and tissue culture media on survival percentage of Araceae family plants *(Syngonium podophyllum, Spathiphyllum wallisii* and *Philodendron scandens*) grown *exvitro* in the greenhouse, survival percentage ranged from 30.00% to 100.00% for *S. podophyllum* and *S. Wallisii* and from 21.66% to 100.00% for *P. scandens.*

The best survival percentage (100%) was recorded for the plantlets produced from the rooting medium which contained MS + 30g/L sucrose and transferred to soil medium containing peatmoss and sand at 3:1 (V/V) for *S. podophyllum*. The interaction effect among planting media, MS salt strength and sucrose concentration was significant for *S. podophyllum* plantlets grown *ex vitro.* Using a mixture of peatmoss and sand 1:1 gave the least value compared with other mixture of *Syngonium podophyllum* (39:81%) and *Philodendron scanders*, (34.40%) with *Spathiphyllum wallisii*, growing the plants in peatmoss alone led to decrease of survival percentage than other mixtures (44.26%).

Spathiphyllum Wallisii plantlets grown in a mixture of peatmoss and sand at 3:1 (Previously grown in ¼ MS + 10 g/L sucrose) recorded the highest survival percentage (100%) during adaptation stage in the greenhouse. *Philodendron scandens* plantlets produced from rooting medium (1/4 MS + 20 g/L sucrose) and transferred to soil medium containing peatmoss and sand at 3:1 recorded the highest survival percentage (100%).

Generally the best planting medium was suitable to the previous plantlets in the greenhouse which contained 3:1 peatmoss: sand (Fig. 1).

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تأثير البيئات المختلفة على نمو بعض نباتات العائلة القلقاسية فى مرحلة التجذير والأقلمة

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يهدف هذا البحث لدراسة تأثير بعض البيئات فى المعمل فى مرحلة التجذير وبيئات الأقلمة فى الصوب (بيئة زراعية) على نمو بعض نباتات العائلة القلقاسية (السنجونيوم – الإسباثيفيلم – الفلودندرون).

أوضحت النتائج أن تأثير كلاً من الأملاح لموراشيجى وسكوج الكاملة المضاف إليها ٣٠ جم/لتر سكروز أعطت أفضل زيادة فى طول النبات ، الوزن الطازج وعدد الجذور لنبات السنجونيوم ، بينما كانت البيئة المحتوية على ٤/١ تركيز الأملاج لموارشيجى وسكوج المضاف إليها ١٠ جم/لتر سكروز مناسبة لنبات الأسباثيفيلم التى أعطت زيادة فى طول النبات وعدد الأوراق. وأن أفضل بيئة لتكوين الجذور كانت لأملاح موراشيجى وسكوج الكاملة المضاف إليها ١٠ جم/لتر سكروز لنبات الفلودندرون. سجلت النتائج لزراعة النباتات على بيئة محتوية ٤/١ قوى أملاح موراشيجى وسكوج مع ٣٠ جم/لتر سكروز أعلى وزن طازج ، طول الجذور وعدد الجذور.

أوضحت البيانات أن تأثير بيئة الزراعة المحتوية على تركيز الأملاح لموراشيجى وسكوج الكاملة مع ٣٠ جم/لتر سكروز أثناء مرحلة التجذير وبيئة الزراعة المحتوية على مخلوط من البيتموس والرمل بنسبة ٣ : ١ أعطت أعلى نسبة نجاح لنباتات السنجونيوم. وكان أفضل نمو وتطور لنباتات السباثيفيلم والفلودندرون أثناء مرحلة الأقلمة الأقلمة عند زراعتها على بيئة محتوية على ٤/١ تركيز الأملاح لموراشيجى وسكوج و ١٠ جم/لتر أو ٢٠ جم/لتر سكروز أثناء مرحلة التجذير وأقلمة هذه النباتات على بيئة زراعة مكونة من مخلوط البيتموس والرمل بنسبة ٣ : ١.

Table (4): Effect of planting media (peatmoss and sand) and tissue culture media (MS salt strength and sucrose concentrations) on the survival percentage of *Syngonium podophyllum*, *Spathiphyllum wallisii and Philodendron Scandens in adaptation stage*

Planting Media (A)																
		Syngonium podophyllum					*Spathiphyllum wallisii*					*Philodendron Scandens*				
Salt strength (B)	Sucrose g/l (C)	Peat-moss	peatmoss + sand 1:1	peatmoss + sand 2:1	peatmoss + sand 3:1	mean	Pea-tmoss	peatmoss + sand 1:1	peatmoss + sand 2:1	peatmoss + sand 3:1	Mean	Pea-tmoss	peatmoss + sand 1:1	Peatmoss + sand 2:1	Peatmoss + sand 3:1	mean
1/4 MS	10	33.33	30.00	61.66	68.33	48.33	58.33	70.00	90.00	100.00	79.58	60.00	50.00	75.00	88.33	68.33
	20	43.33	38.33	63.33	76.66	55.41	35.00	65.00	78.33	93.33	67.92	65.00	58.33	91.66	100.00	78.75
	30	48.33	46.66	63.33	70.00	57.08	38.30	63.33	81.67	90.00	68.33	43.33	30.00	78.33	91.66	60.83
Mean(B)						53.61 c					71.94 a					69.30 a
1/2 MS	10	46.66	43.33	70.00	70.00	57.50	46.66	58.33	63.33	66.66	58.75	35.00	23.33	65.00	70.00	48.33
	20	53.33	30.00	73.33	78.33	58.75	40.00	60.00	66.66	71.66	59.58	43.33	48.33	80.00	85.00	64.17
	30	66.66	40.00	78.33	90.00	68.75	30.00	61.66	68.33	71.66	57.91	40.00	26.66	70.00	78.33	53.75
Mean(B)						61.67 b					58.75 b					55.42 b
MS	10	36.66	38.33	76.66	80.00	57.91	55.00	75.00	85.00	90.00	76.25	31.66	21.66	56.66	65.00	43.75
	20	63.33	31.66	90.00	95.00	70.00	53.33	71.66	81.66	86.66	73.33	41.66	40.00	73.33	78.33	58.33
	30	75.00	60.00	95.00	100.00	82.50	41.66	56.66	80.00	80.00	64.58	40.00	30.00	68.33	75.00	53.33
Mean						70.14 a					71.39 a					51.80 c
Mean	(A)	51.85 c	39.81 d	74.63 b	80.92 a		44.26 d	64.63 c	77.22 b	83.33 a		44.44 c	36.40 d	73.15 b	81.30 a	
Mean	(C)	54.58 c		61.39 b	69.44 a		71.53 a		66.94 b	63.61 c		53.47 c		67.08 a	55.97 b	

L.S.D at 5% for inter

A×B =	**9.30**	**5.87**	**N.S**
A×C =	**N.S**	**5.87**	**3.82**
B×C =	**N.S**	**5.09**	**3.31**
A×B×C =	**16.11**	**N.S**	**6.62**

Table (3): Effect of MS salt strength and sucrose concentrations on the growth and development of *Philodendron scandens* grown *in vitro* (rooting stage) after 6 weeks from culturing

Salt strength (B)																								
Sucrose g\l (A)	Plant length (cm)				Number of leaves				Leaf area (cm^2)				Fresh weight (gm)				Root length (cm)				Number of roots			
	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean
10	3.00	2.75	2.86	2.87a	5.90	5.50	5.59	5.66a	0.84	1.60	1.06	1.17a	0.30	0.33	0.20	0.28 b	3.34	4.34	3.11	3.59 c	4.86	3.91	4.73	4.50 b
20	2.59	2.65	2.70	2.64a	5.36	6.09	5.00	5.48a	0.99	1.36	1.50	1.29a	0.30	0.25	0.26	0.27 b	6.00	3.55	3.32	4.29 b	4.95	4.18	4.14	4.42b
30	2.52	2.81	2.50	2.61a	5.77	5.36	5.60	5.75a	0.72	1.21	0.79	0.91a	0.49	0.35	0.20	0.35a	7.80	5.00	4.30	5.70a	5.41	6.00	4.45	5.28a
Mean	2.70 (a)	2.74 (a)	2.68 (a)		5.67 (a)	5.65 (a)	5.39 (a)		0.85 (a)	1.39 (a)	1.11 (a)		0.36 (a)	0.31 (b)	0.22 (c)		5.71 (a)	4.29 (b)	3.57 (c)		5.07 (a)	4.70 (a)	4.44 (b)	
L.S.D. 5% Inter.																								
A			**N.S**				**N.S**				**N.S**				**0.05**				**0.59**				**0.59**	
B			**N.S**				**N.S**				**N.S**				**0.05**				**0.59**				**0.59**	
A× B			**N.S**				**N.S**				**N.S**				**0.08**				**1.01**				**1.01**	

Table (1): Effect of MS salt strength and sucrose concentrations on the growth and development of *Syngonium podophyllum* grown *in vitro* (rooting stage) after 6 weeks from culturing

Salt strength (B)																								
Sucrose g\l (A)	Shoot length (cm)				Number of leaves				Leaf area (cm^2)				Fresh weight (gm)				Number of roots				Root length (cm)			
	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean	1/4 MS	1/2 MS	MS	Mean
10	4.56	4.39	3.81	4.25b	13.88	9.71	10.00	11.20a	0.83	1.28	0.92	1.01a	0.83	0.99	1.10	0.97 b	6.67	4.00	1.75	4.14b	4.70	3.14	1.29	3.04 c
20	4.13	5.00	3.35	4.16b	3.73	10.50	13.25	10.83ab	2.00	1.03	0.78	1.27a	0.74	1.26	1.18	1.06 b	6.83	8.00	8.67	7.83 a	6.30	4.33	5.79	5.47a
30	5.00	5.68	4.04	4.91a	8.13	10.29	11.58	10.00b	0.89	1.25	0.77	0.97a	0.94	1.45	1.44	1.28a	8.21	7.96	8.92	8.36	3.40	4.18	5.75	4.44b
Mean	4.56 b	5.02 a	3.73 c		10.25 b	10.17 b	11.61 a		1.24 a	1.19 a	0.82 a		0.84 b	1.23 a	1.24 a		7.24 a	6.65 a	6.45 a		4.80 a	3.88 c	4.28 b	

L.S.D. 5% Inter.

A	**0.35**	**1.18**	**N.S**	**0.11**	**1.05**	**0.33**
B	**0.35**	**1.18**	**N.S**	**0.11**	**N.S**	**0.33**
A × B	**0.60**	**2.04**	**N.S**	**N.S**	**1.8**	**0.58**

Table (2): Effect of MS salt strength and sucrose concentrations on the growth and development of *Spathiphyllum wallisii* grown *in vitro* (rooting stage) after 6 weeks from culturing

Salt strength (B)																								
Sucrose g\l (A)	**Shoot length (cm)**				**Number of leaves**				**Leaf area (cm^2)**				**Fresh weight (gm)**				**Number of roots**				**Root length (cm)**			
	1/4 MS	**1/2 MS**	**MS**	**Mean**	**1/4 MS**	**1/2 MS**	**MS**	**Mean**	**1/4 MS**	**1/2 MS**	**MS**	**Mean**	**1/4 MS**	**1/2 MS**	**MS**	**Mean**	**1/4 MS**	**1/2 MS**	**MS**	**Mean**	**1/4 MS**	**1/2 MS**	**MS**	**Mean**
10	2.96	3.05	3.48	3.16a	13.46	10.68	12.50	12.21a	0.37	0.40	0.38	0.38a	0.50	0.50	0.43	0.48a	5.07	4.48	6.16	5.24a	2.16	1.15	1.30	1.54a
20	3.25	2.20	2.80	2.75b	14.75	11.75	12.21	12.84a	0.39	0.41	0.44	0.41	0.60	0.60	0.23	0.44a	4.71	2.44	4.50	3.88b	1.88	0.98	1.48	1.45a
30	2.07	2.35	2.46	2.29c	10.96	11.36	11.36	11.23b	0.40	0.53	0.38	0.44a	0.40	0.53	0.56	0.50	3.96	2.64	4.39	3.66b	1.28	1.14	1.30	1.24b
Mean	2.76 a	2.51 b	2.91 a		13.06 a	11.20 c	12.02 b		0.39 a	0.45 a	0.40 a		0.47 a	0.54 a	0.41 a		4.58 a	3.19 b	5.02 a		1.77 a	1.09 c	1.36 b	

L.S.D. 5% Inter.

A	**0.20**	**0.85**	**N.S**	**N.S**	**0.54**	**0.19**
B	**0.20**	**0.85**	**N.S**	**N.S**	**0.54**	**0.19**
A × B	**0.35**	**1.46**	**N.S**	**N.S**	**0.94**	**0.32**

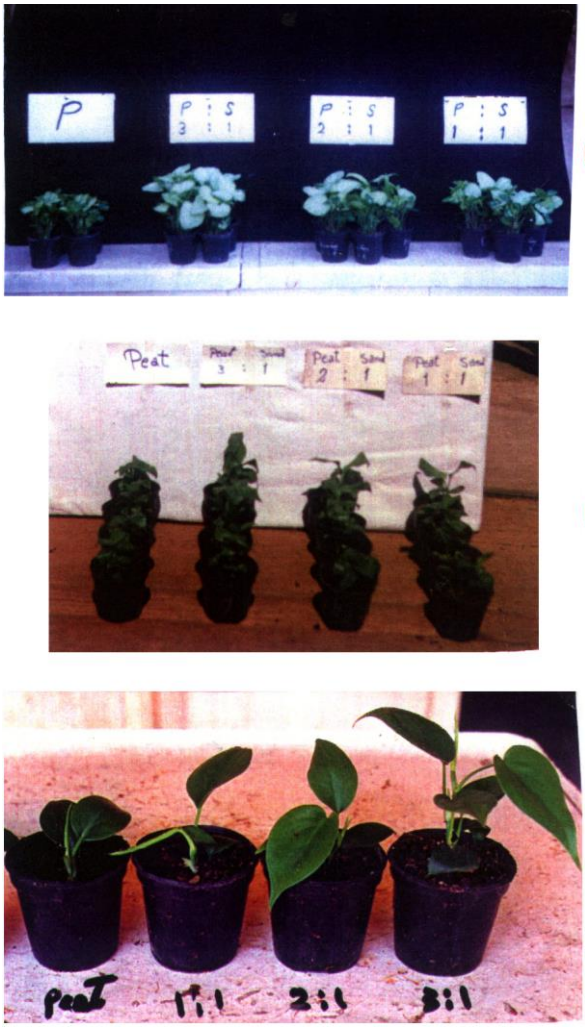

Fig (1): Effect of planting media on the growth and development of *Syngonium podophyllum* (A), *Spathiphyllum wallisii* (B) and *philodendron scandens* (C) grown *ex vitro* (adaptation stage) after three months from survival.

1- peatmoss 100%.
2- 3 Peatmoss : 1 sand (v/v).
3- 2 Peatmoss : 1 sand (v/v).
4- 1 Peatmoss : 1 sand (v/v).